

VERIFICATIONS.

Indications.—The detailed comparison of the tri-daily indications for December, with the telegraphic reports for the succeeding twenty-four hours, shows the general percentage of verifications to be 84.9 per cent. The percentages for the four elements are: Weather, 91.0; Direction of the Wind, 83.3; Temperature, 83.4; Barometer, 81.0 per cent. By geographical districts they are: for New England, 86.6; Middle States, 88.7; South Atlantic States, 87.4; Eastern Gulf States, 86.3; Western Gulf States, 82.9; Lower Lake region, 86.5; Upper Lake region, 83.2; Tennessee and the Ohio valley, 84.8; Upper Mississippi valley, 80.3; Lower Missouri valley, 80.4; Northern Pacific coast region, 87.0; Central Pacific coast region, 90.7; Southern Pacific coast region, 92.0. There were 101 omissions to predict out of 3,813 or 2.65 per cent. Of the 3,712 predictions that have been made, 117, or 3.15 per cent. are considered to have entirely failed; 116, or 3.12 per cent. were one-fourth verified; 495, or 13.34 per cent. were one-half verified; 441, or 11.88 per cent. were three-fourths verified; 2,543, or 68.51 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

Cautionary Signals.—215 Cautionary Signals were displayed during the month, of which 182, or 84.7 per cent., were justified by winds of 25 miles per hour or over at, or within a radius of, 100 miles of the station. 103 Off-shore Signals were displayed, of which 94 or 91.3 per cent. were fully justified, 96 or 93.2 per cent. justified as to direction and 95 or 92.2 per cent. were justified as to velocity. Sixty-three of the Off-Shore were changed from Cautionary. 318 Signals of both kinds were displayed, of which 276 or 86.8 per cent. were fully justified. The above does not include signals ordered for 49 display stations, where the velocity is only estimated. Thirty-five signals were ordered late.

NAVIGATION.

Stage of Water in Rivers.—In the table on the right-hand side of chart No. III are given the highest and lowest stages of water, as observed on the Signal Service river-gauges, during the month of December, 1880. The Arkansas, Missouri, Mississippi, lower Ohio, Red and Cumberland rivers were at a fair stage of water during the entire month. In the upper Ohio the river fell from the 6th, and on the 29th was at its lowest stage, one foot ten inches above bench-mark at Pittsburgh. In California the Sacramento rose rapidly on the 20th, but no flood occurred.

Ice in Rivers and Harbors.—The following items show the condition of the navigable waters throughout the United States, during the month of December, 1880, in respect to the formation of ice. In general, the upper portions of the Missouri and Mississippi rivers and tributaries, and lakes Superior, Michigan and Huron continued frozen and navigation suspended throughout month; on lakes Erie and Ontario navigation was entirely closed by the 10th, and towards the end of the month the Arkansas and Ohio rivers froze over and ice formed generally along the Atlantic and Gulf coasts. During the first half of the month considerable ice formed in the Frazer and Columbia rivers, which is noted more in detail below. *Missouri River.*—At Fort Benton ice was observed in the river on November 16th, and during the night of the 22d the river closed. During the whole of December this river remained closed by ice, from Omaha upward. At Leavenworth floating ice was reported from the 1st to 5th; on the 6th it gorged and the river remained frozen over to end of month, when the ice was thirteen inches thick. *Kansas River.*—Lawrence, Kans., 31st, ice on river 14 inches thick. *Mississippi River.*—From Davenport, Iowa, northward, this river continued frozen throughout the month. Keokuk, Iowa, 1st to 7th, floating ice; 8th, river closed; 11th, breaking up in places; 12th to 31st, open in places. St. Louis, Mo., 8th to 12th and 28th to 31st, navigation suspended by ice in river; 30th, river gorged; 31st, persons crossing river on ice. Cairo, Ill., 27th, river frozen; 30th, people crossing on ice. Memphis, Tenn., 30th and 31st, floating ice. *Des Moines River.*—Boonsboro, Iowa, 31st, ice on river 16 to 18 inches thick. *Grand or Neosho River.*—Fort Gibson, Ind. T., 28th, river frozen over; 29th, ice 5 inches thick. *Arkansas River.*—Little Rock, Ark., 29th, floating ice; 30th, river frozen entirely across, from this place up to Fort Smith, and gorged at Pine Bluff. *Red River.*—Shreveport, La., floating ice on the 29th and 31st. *Ohio River.*—Pittsburgh, Pa., 29th, river frozen, navigation closed. Wellsburg, W. Va., 1st., ice broke; 3rd, navigation resumed; 29th, river closed by ice; 31st, teams and people crossing. Portsmouth, Ohio, 21st to 29th, floating ice; 29th, during night, frozen over; 30th, people crossing. Cincinnati, Ohio, 25th, ice forming; 29th, river frozen over, navigation suspended. Vevay, Ind., 27th, navigation suspended; 31st river frozen over and people crossing. Louisville, Ky., 28th, navigation closed; canal completely and river partly frozen; 29th, river frozen over. Cairo, Ill., 29th, navigation suspended by floating ice. *Monongahela River.*—Morgantown, W. Va., 10th, river frozen; 14th, ice broke up; 28th, frozen over. *Lake Superior.*—Duluth, Minn., 4th, ice disappeared from lake; 6th, ice formed and navigation closed. Marquette, Mich., 5th, ice moved from around the docks but formed again on the 10th. *Lake Michigan.*—Chicago, lake generally frozen throughout the month; the ice moved away, temporarily, from the docks on the 5th and 14th. *Lake Huron.*—Alpena, Mich., 12th, Thunder Bay full of ice, 3 to 5 inches thick. Port Huron, Mich., 10th, navigation closed; 11th, ice 9 inches thick; 22nd, ice bridge across bay from Port Edwards to Fort Gratiot Lighthouse.

St. Clair River.—Marine City, Mich., 27th, river frozen over; teams crossing. Port Huron, Mich., 27th, river open; 29th to 31st, gorged at mouth of Black River; 30th, ferry-boats making occasional trips to and from the Canadian shore; 31st, navigation suspended. *Lake Erie*.—Toledo, O., 5th, navigation closed. Cleveland, O., 29th, lake frozen as far as visible. Erie, Pa., 3rd, navigation closed. Buffalo, N. Y., 8th, navigation closed. *Niagara River*.—Buffalo, N. Y., 6th, river frozen over; Ft. Niagara, floating ice on the 12th, and from 28th to 31st. *Lake Ontario*.—Charlotte, N. Y., 10th, navigation closed. Oswego, N. Y., 10th, river frozen over below the bridge. *Lake Champlain*.—Burlington, Vt., 25th, lake frozen between docks. *Providence River*.—Providence, R. I., 30th, river frozen as far down as Pawtuxet. *Chesapeake Bay*.—Baltimore, Md., 30th, ice 3 to 5 inches thick formed in harbor, large number of steamers went into winter quarters; 31st, considerable ice in bay as far south as Sandy Point; ice-boats clearing channel. Norfolk, Va., 31st, cold weather continues closing navigation in harbor and rivers. *James River*.—Dover Mines, Va., 31st, river frozen over. Along the immediate *Atlantic and Gulf coasts*.—Newburyport, Mass., 14th to 16th, floating ice in river; harbor free of ice at close of month. Boston, Mass., 31st, considerable floating ice in harbor. Wood's Holl, 30th, harbor covered with ice. New York City, 23rd, considerable floating ice in harbor and rivers. Delaware Breakwater, Del., 30th and 31st, harbor filled with floating ice. Chincoteague, Va., 31st, Assateague channel frozen over. Portsmouth, N. C., 30th, all creeks and inlets frozen over. New River, N. C., 31st, ice strong enough to bear horse and rider. *Corpus Christi Bay*.—Corpus Christi, Tex., 30th, bay frozen along shore and around wharf posts; ice $1\frac{1}{2}$ inches thick. *On the Pacific coast*.—*Columbia and Willamette Rivers*.—December 4th, floating ice in river at Portland, Or., 5th, no ice in river at Portland, but on the Columbia, above the mouth of the Willamette, navigation was closed by the formation of ice. On the Columbia, below the mouth of the Willamette, navigation was closed to sea-going vessels by an ice gorge at Willow bar, though river steamers from Portland were able to reach Astoria via Willamette Slough. 11th, at noon, the ice gorge at Willow bar broke and navigation was thereby opened to sea-going vessels. 12th, navigation between Portland and the Cascades opened. At Umatilla navigation was suspended by floating ice from the 3rd to the 13th; on the 13th and 14th the river was filled with floating logs and telegraph poles, occasioned by the breaking of a boom in the Yakima River, (entailing a loss of \$30,000,) but entirely free from floating ice. On the 29th navigation was again closed by floating ice. *Frazer River, British Columbia*.—Chilliwack, B. C., 5th, ice gorge, (formed during preceding cold week and piled up to a height of 20 feet,) broke during the prevalence of a warm south wind and consequent general thaw. Much damage resulted from the combined effects of the heavy rain, the melting of snow in mountains and the breaking of ice gorges in the Frazer River and tributaries.

High Tides.—Atlantic City, 21st, covered railroad tracks and meadows preventing arrival of trains; 26th, tracks and meadows again submerged, communication interrupted. Little Egg Harbor, 21st and 26th, washing out telegraph poles. Sandy Hook, 26th, undermining office building. Bangor, Me., 5th, wharves submerged. Santa Cruz, Cal., 30th, 31st, unusually high tide, followed by an extraordinary low tide, which was said to be 10 feet below average.

TEMPERATURE OF WATER.

The temperature of water, as observed in rivers and harbors at Signal Service stations, with the average depth at which observations were taken, is given in the table on the left hand side of chart No. III. Owing to ice &c., observations are wanting, as follows: Alpena, Detroit, Escanaba, Grand Haven, Sandusky and Toledo from 1st to 31st; Buffalo from 7th; Cleveland, 9th to 12th and from 17th; Milwaukee from 21st; Wilmington, 8th to 20th. Observations were taken at various times at Chicago and Marquette on 5 days, and at Duluth on 10 days.

ATMOSPHERIC ELECTRICITY.

Thunderstorms were frequent in Iowa, Missouri, Tennessee and the Ohio valley on the 4th and 5th, and the Gulf States from the 16th to the 19th; elsewhere, few or none were reported.

Atmospheric Electricity Interfering with Telegraphic Communication.—Silver City, N. M., 29th. Bismarck, 28th, very strong currents on wires in all directions. Fort Bennett, Dak., 29th, on wires in all directions.

Auroras.—The remarkable cloudiness of the month in the northern part of the United States prevented the display of auroras, even if they had occurred. At St. Vincent, Minn., however, auroras were observed on eight out of the eighteen evenings on which cloudiness did not prevail. The display of the 1st was probably general from Maine to Dakota, as it was observed at Cornish and Gardiner, Me., at Clinton, Cresco, and Independence, Iowa, Bismarck and St. Vincent. In the Lake region and the greater part of New England cloudy or stormy weather prevailed. On the 7th the aurora was observed at Newport, Mt. Washington, Cambridge, (Harvard University, a. m. of the 8th,) Mass., and at St. Vincent, Minn. Cloudy weather prevailed that night in the Lake region. On the 28th a display was noted at Eastport, Me., and Alpena, Mich., while cloudy weather prevailed at all intermediate stations. Displays were observed at Portland and Bangor, Me., on the 1st, a. m.,